California Energy Commission
Dockets Office, MS-4
Docket 08-DR-01
1516 Ninth Street
Sacramento, CA 95814-5512

DOCKET
08-DR-1
DATE
RECD. JUN 13 2008

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Re: 19 June 2008 Load Management Standards Workshop: Enabling Technologies
Input and comments by the Cassatt Corporation

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Input Summary

Cassatt Corporation is proposing that the CEC consider technology to target corporate data centers for Load Reduction (LR) and Demand Response (DR) initiatives. Data centers are ripe for this opportunity: they are massive users of electricity (estimated at 1.5% of total US energy consumption) and have been shown to waste 35% or more of their power with computers that are temporarily idle. However, data centers do not yet participate in LR or DR programs. The enabling technology that can permit LR or DR for data centers is known as Active Power Management, which could safely shut down idle servers for brief or extended periods of time.

Unlike LR and DR programs in traditional industrial settings (i.e. lighting, cooling, etc.), power management in data centers has been very difficult to achieve. Traditional belief had it that servers could not be powered-down at will (as with lights or HVAC). However, affordable technology now exists that can allow the safe, controlled power down/up of computer servers in response to external triggers, schedule, level-of-use, etc. Furthermore, this technology is completely compatible with existing Auto-DR technologies and protocols.

Corporate Data Centers: a large opportunity for voluntary load management

In the 2007 Report to Congress on Server and Data Center Energy Efficiency (in response to Public Law 109-431), the EPA estimated that 1.5% of US power consumption in 2006 (61 billion kWh) went to powering corporate data centers, having nearly doubled since 2000. That number is expecting nearly double again by 2011 nearly 100 billion kWh. However, this source of consumption has not been targeted for LR or DR because it's been believed that, for software reliability reasons, servers must be on 100% of the time -- regardless of the work they were performing.

However, in certain data centers server use is sporadic at best, particularly where server use may not be critical to the business (i.e. in server "labs" where software testing/development occurs). There may be prolonged periods during the day/night or even month, when servers are idle for 35% of the time or greater – with each server drawing 200w-500w each – and where larger data centers house thousands of such servers. Keep in mind that for every server Watt reduced, there is also the indirect benefit of reducing a Watt or more of cooling power needed.

Given the relative energy density of data centers relative to commercial office space or to typical industrial space, bringing LR and DR into these environments appears to be a large untapped opportunity.

Server Power Management as an enabling technology for load management

Enabling technologies are now available which could safely and "gracefully" power-down (and power-up) servers in a manner that is not harmful to the software, and does not adversely affect the availability of the software. The technology supports various control "policies" that can perform regular load shedding (i.e. based on time-of-use), or temporarily-triggered load shedding (as in the case of Auto-DR). Other policies are also available for sustained power reduction based on use patterns of the servers.

The technology is compatible with existing DR triggers (i.e. PG&E's DRAS servers) and is completely technology-neutral with respect to the vendors, models and types of server hardware and software under control. Cassatt is in communication with LBNL's Demand Response Research Center to ensure on-going technical compatibility.

In addition to the LR and DR opportunity, a number of authorities have already indicated that server power management is a critical component of overall energy efficiency strategies. They include the US EPA, Gartner Research, The 451 Group, The Uptime Institute, Emerson Electric and EDS Inc. (complete references & sources at http://www.cassatt.com/pm_reco.php).

In the past, this technology has not been available because load reduction in data centers is not as simple as powering-down lighting, HVAC and manufacturing equipment. Only recently has industry pursued the "graceful" shut-down of servers. This means that all software and operating system activity is first halted, and data is saved. Only then is the underlying hardware powered-down. Performing these actions in this sequence ensures that when power is restored, the servers return to their desired state as quickly as possible. The software also confirms proper power-up of servers.

Two Examples: Load reduction & Auto-DR

(1) Example of Auto-DR:
A data center with a number of high, medium and low-priority servers receives notice of an Auto-DR event. For the duration of the event, the power management system would power-down many of the low-priority servers and a few of the medium-priority servers, while not powering-down any high-priority servers. The total quantity of servers would be computed and measured to ensure that the minimum power reduction requirement (e.g. 15% for certain PG&E programs) was met. At the completion of the event, the servers would be returned to their original powered-on state.

(2) Example of voluntary load reduction:
During specific periods of the day (or, around-the-clock), power management policies can be invoked which power-down any server which is deemed to be "idle". Even during peak operating periods of the day, any idle servers can be automatically identified and safely shut-down, saving both server power as well as cooling power. Server power can be restored automatically when demand deems it necessary, at pre-determined times, or via manual power control.

Summary & State of Proposed Technology

Power Management software (such as available from Cassatt) is available today. Cassatt can provide references where this software is in use, and will be presenting a server power management case-study on June 26, 2008 in Santa Clara at the Silicon Valley Leadership Group's (SVLG) Energy Summit '08. We believe this technology can be applied to Auto-DR instances as well.

If EPA statistics are accurate, broad application of server power management in LR and DR scenarios can save the country massive electricity expense, with California benefiting disproportionately due to its size and concentration of high-technology businesses housing data centers.

About Cassatt

Cassatt helps companies run a green data center with innovative technologies and software solutions to maximize energy and operational efficiencies. The Cassatt Active Response product line is based on patent-pending Active Power Management technology that safely and intelligently powers servers off and on, based on demand, cutting a data center's gross energy usage by as much as 35% or more. Cassatt is based in San Jose, Calif., and is on the Web at cassatt.com

Cassatt

Load Management Technology Proposal

To the California Energy Commission Load Management Standards Workshop

Docket 08-DR-01

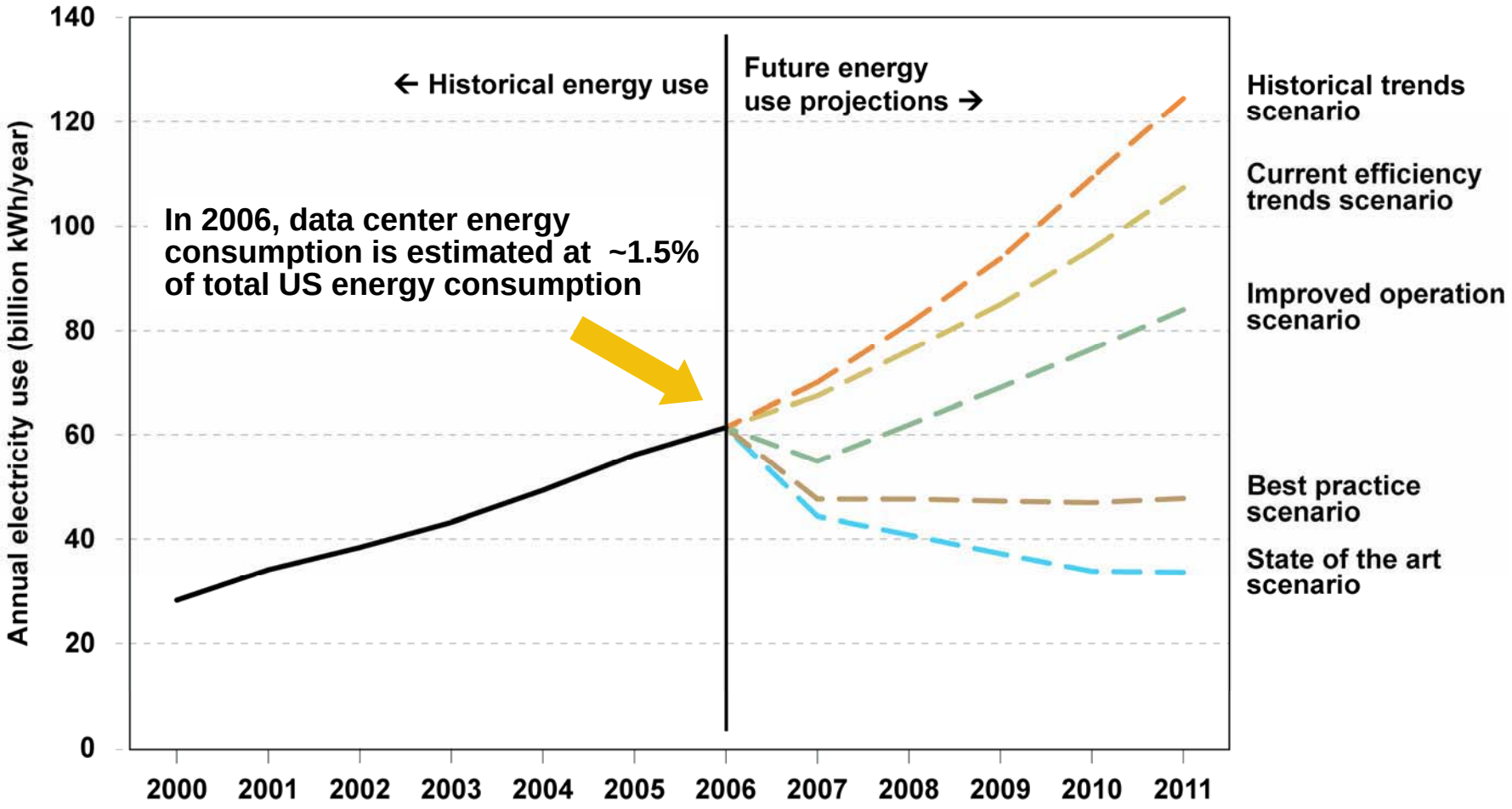
Ken Oestreich

Cassatt Corporation

19 June, 2008

How Big is the Data Center Problem?

US Data Center Energy Consumption (estimates from the US EPA report, 2007)



Data center servers (computers) waste huge amounts of power when idle

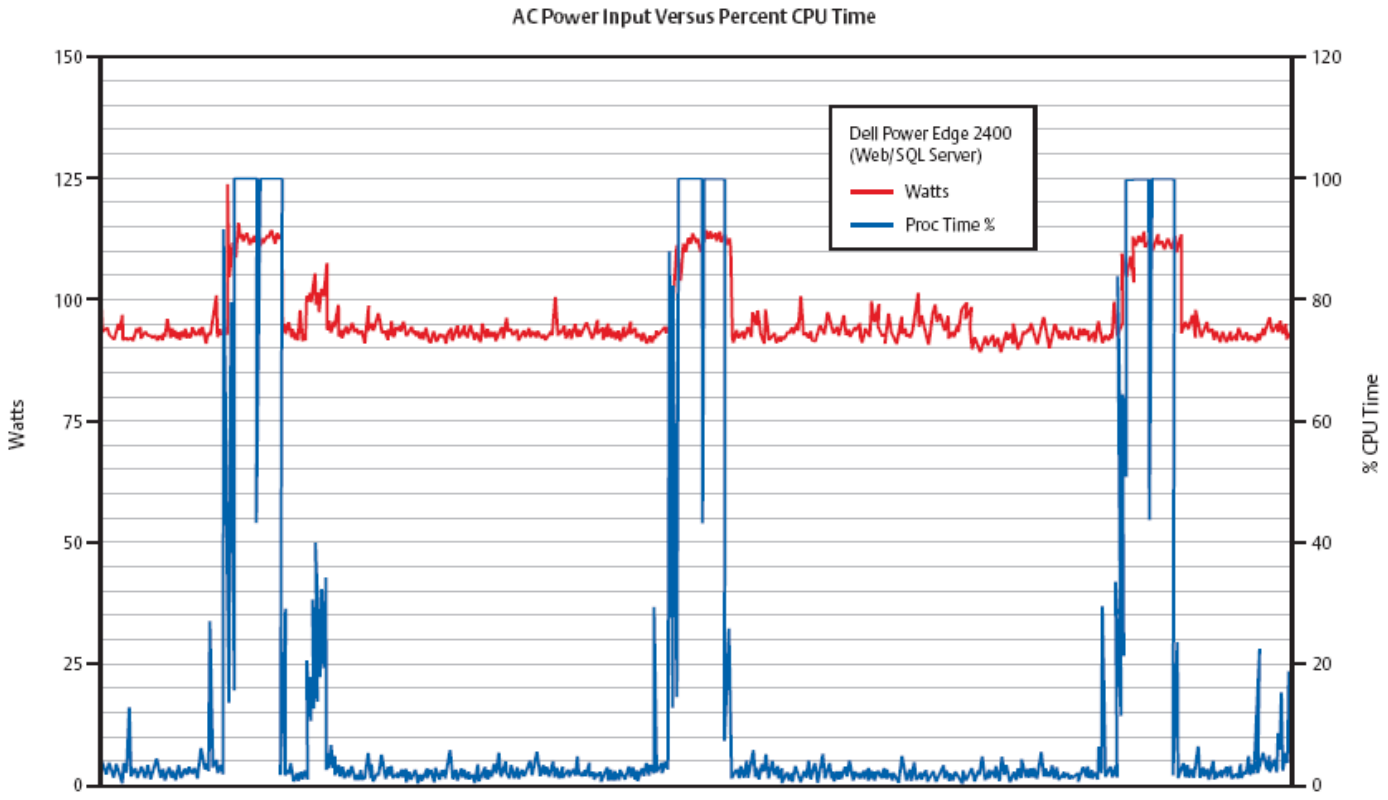


Figure 11. Low processor activity does not translate into low power consumption.

Source: *"Energy Logic: Reducing Data Center Energy Consumption by Creating Savings that Cascade Across Systems"* Emerson Electric, 2007

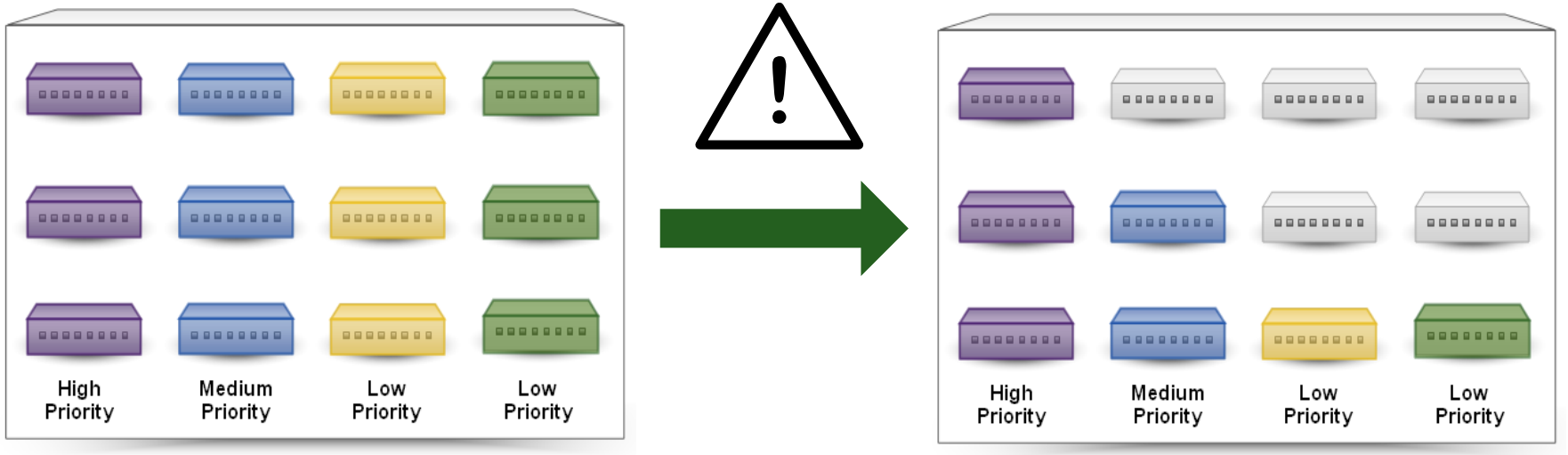
Active Power Management:
A Unique Approach to Solving Idle Power Waste and Responding to Load-Shedding Events

Policy-Based—Business priorities determine when, where, and how to power off servers; Easily integrated w/external triggers like DR.

Application Aware—Knows when and how applications must be systematically powered off and brought back on, as well as application inter-dependencies across multiple servers

Hardware and Software Independent— Manages any platform, requires no change to existing hardware and software configurations; compatible with existing power distribution/UPS equipment

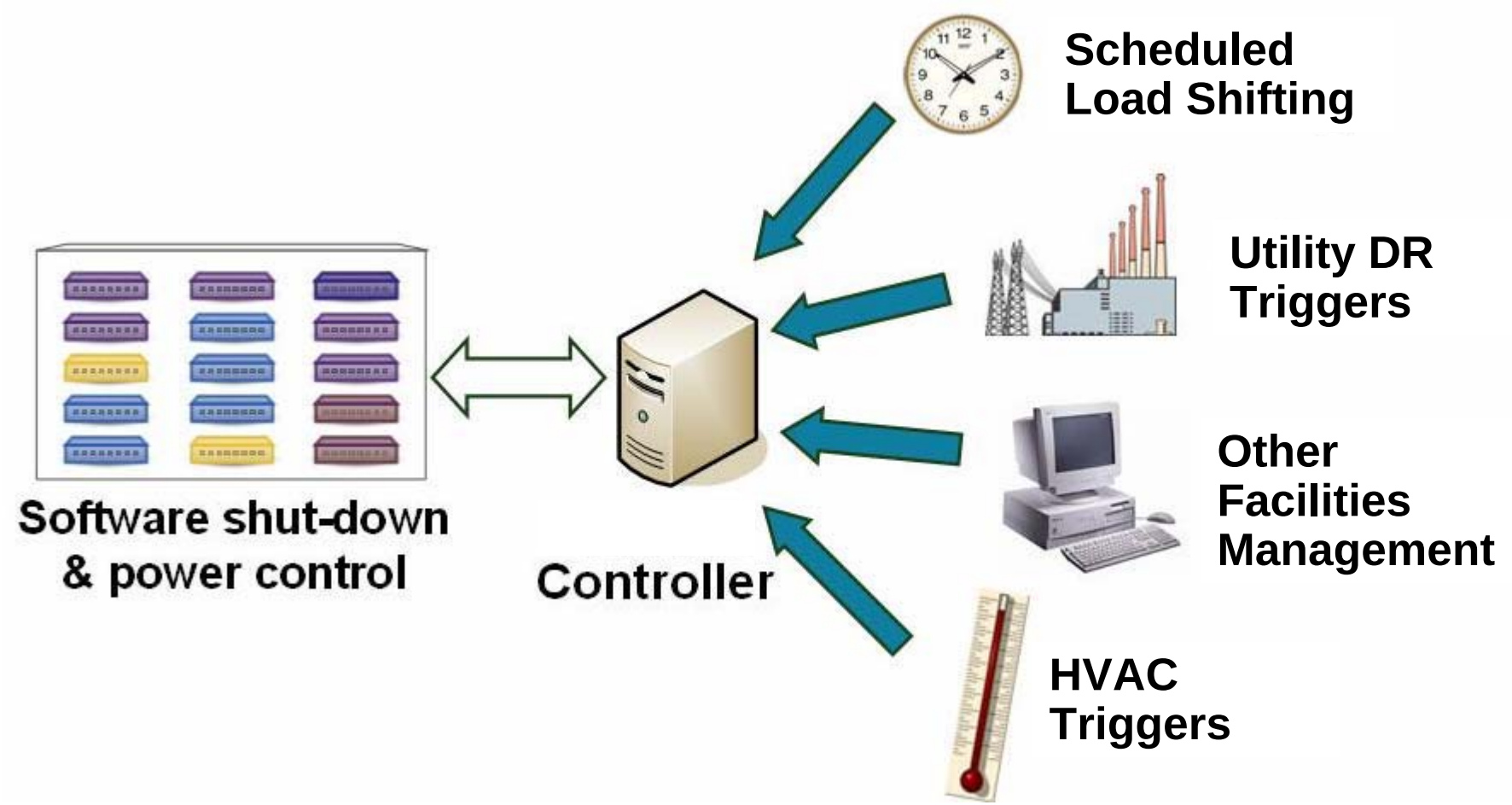
Demand Response Scenario: Minimize powered-on servers



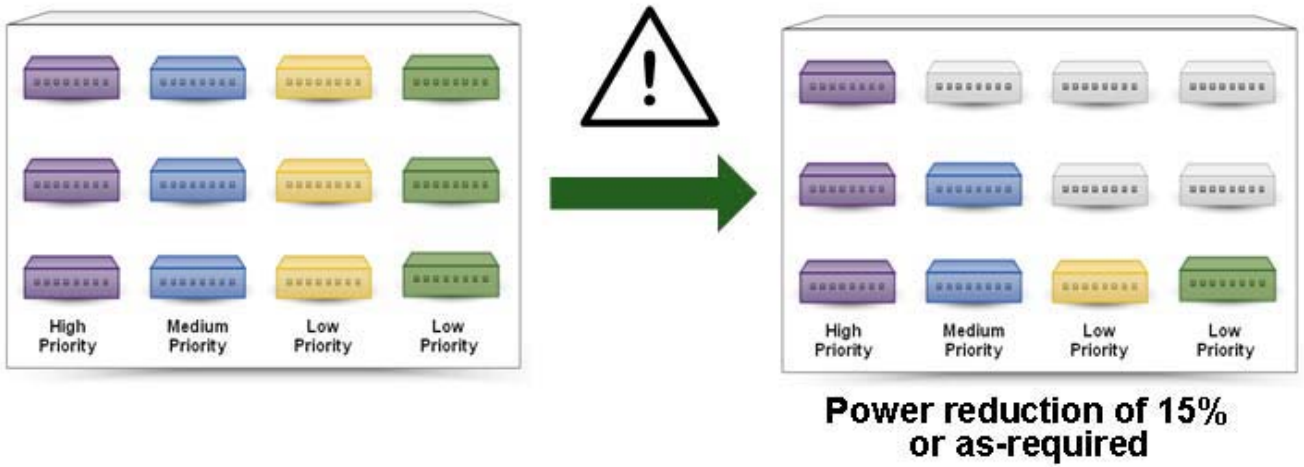
Power reduction of 15% or as-required

Similar to “dimming the lights” during critical periods

Active Power Management: Functional Overview



How Big is the potential?



Example:

- 20,000 f^2 data center
- 6,000 servers @ 200w ea. (1.2 mW + HVAC)
- 15% reduction during DR event:
  - ~ 180 kW direct reduction
  - ~ 200 kW indirect reduction from shed HVAC load